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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Plant Pest Control Division
Washington 25, D. C.

PESTS OR PESTICIDES

Americans are inclined to take for granted their natural resources, good health, and wholesome food as a part of their heritage. Little thought is given to the constant battle taking place in the production of food and other resources and the protection of health from opposing natural forces--pests. Pesticides are the important weapons used against insects, diseases, nematodes, weeds, and rodents in this struggle. Scientists have recognized the importance of pesticides and have reported their conclusions. One such report is as follows:

"No one knows exactly what would happen if the use of pesticidal chemicals on the farm should be abandoned, but it is safe to say that we could not commercially produce apples, peaches, potatoes, citrus, and tomatoes, to mention only a few crops, and yields of many others would be drastically reduced. It seems evident that the American people cannot be fed adequately unless crops and livestock are protected from insects and other pests."

"Pesticide Subcommittee of the Food Protection Committee of the National Academy of Science, National Research Council (Report 1956)."

It is difficult to realize that our forefathers suffered from famine and that many deaths were caused by pests in those early days. The bubonic plague in Europe and the great potato famine are notable examples, the former carried by fleas from rats, the latter attributed to a fungus called "late blight." As recently as 1874, grasshoppers caused damage so great in our Middle West that Congress called it a national disaster. Much of the world still stands helplessly by while insects, insect-borne diseases of man and animals, plant diseases, and other pests destroy their food supplies and threaten their health.

Despite the tremendous advances which have been made in pest control in the United States, pests still destroy much that man wants and needs. Some annual estimates of their destructiveness are as follows:

Insects - 12% of total agricultural output.
- 14 billion board feet of sawtimber, or enough lumber to build 1-1/3 million houses.

Weeds - \$4 billion.

Plant diseases - \$3 billion.

Rats and rodents - between \$1 and \$2 billion.

The farmer, the rancher, the lumberman, and others who suffer the initial loss find it hard to accept the proposition that pest control isn't necessary. Over a period of years farmers and scientists have developed four basic ways to alleviate pest damage. The four methods are:

1. Cultural practices.
2. The use of resistant varieties.
3. The use of biological agents.
4. The use of pesticides.

Each controls pests in a different way and to different degrees. Many times all four are required to attain the necessary protection for profitable production.

On modern farms today cultural control, the use of resistant varieties, and biological control methods are accepted normal agricultural practices. These methods cannot in all instances assure pest-free produce. To meet the demand for perfection by a discriminating public, farmers find it necessary to use pesticides to produce marketable food.

Pesticides have been called a cure for a situation that is already bad. They are materials which have been developed because of their ability to destroy, prevent, repel, or mitigate the activity of insects, weeds, fungus, nematodes, rodents, and bacteria. Pesticides are never popular with farmers and others who must make the decision whether or not to use them to protect their crops or their livestock. Even though these chemicals give reliable control of pests when and where needed there is always the hope that a better, less expensive way will be found.

How safe are pesticide chemicals?

To meet requirements of stringent Federal and state laws governing the marketing and use of pesticides, toxicological research begins as soon as a compound is found to have pesticidal value. The earliest tests involve acute toxicity studies on laboratory animals. Research workers must know whether the compound is safe for use in further experiments.

If the compound passes the early tests for safety and effectiveness and is suitable for use on food crops, detailed studies are made by feeding variable amounts of the compound in the laboratory animal diet over an extended period of time. These are known as 90-day subacute studies and are usually conducted on laboratory rats. Microscopic studies are made of the animal tissues to determine what effects, if any, the compound has had on internal organs. Careful records on growth rates and all other gross symptoms are kept.

When field testing begins, extensive studies are made to determine whether or not residues are left on food crops. At the same time, lifetime studies are started to determine the biological effects on laboratory rats fed on feed contaminated at levels dictated by the results of the subacute feeding experiments. Where tests on larger animals are needed, the length of test does not always require a full

lifetime. In addition, further skin absorption or irritation tests are run to determine whether or not the chemical is absorbed into the body, and what effects it has, if any. Test animals are observed constantly to determine absorption, excretion, and any biological changes that may occur. Such testing may run two or three years or more.

During this period many different scientists will have tested the compound and will have learned what happens when the material is inhaled, when it touches the skin, and when minute amounts of residues are consumed. These are severe tests for the compounds and many more are dropped at the different stages of research than are eventually released for use as pesticides.

All of this research is condensed and is available for everyone to read on the label of each container of pesticide finally approved for public use. To quote Dr. J. H. Lilly, Head, Department of Entomology and Plant Pathology, University of Massachusetts, in his address before an open forum on use of pesticidal chemicals at Boston, Massachusetts, on October 7, 1958:

"It is reassuring to know that the law pertaining to insecticide labels is both rigid and specific. You may be surprised to hear that the requirements for an insecticide label that will pass in interstate commerce are far more complete and exacting than the labels of dozens of patent medicines that are readily available at any drugstore."

Are pesticides regulated?

The first Federal bill concerning the manufacture, labeling, and interstate shipment of pesticides was introduced into Congress in 1908. This bill became law in 1910. Since then, laws and regulations have been improved or expanded to assure farmers and consumers adequate safeguards in the use of these chemicals. Today, agricultural chemicals basically are regulated by two Federal laws and by laws and regulations in nearly every state.

The Federal Insecticide, Fungicide and Rodenticide Act of 1947 is administered by the U. S. Department of Agriculture. It requires manufacturers to prove that pesticide chemicals are effective against destructive pests. It further requires labeling of pesticides to indicate the specific pests the formulation will control, the crops on which it can be used, how it must be applied, and warning or caution statements, if necessary, concerning the care to be taken in handling or using the material.

The Miller Pesticide Residue Amendment to the Federal Food, Drug and Cosmetic Act of 1938 was signed into law in 1954. It is administered by the Federal Food and Drug Administration, with a limited amount of cooperation from the U. S. Department of Agriculture. This law establishes the procedures whereby the Food and Drug Administration may set a tolerance or maximum amount of residue of a chemical which may legally remain in or on a food crop when it enters interstate commerce. The established tolerance always has a sufficient margin of safety so that it is safe for humans. Food crops bearing residues above the established tolerances may be seized, kept off the market, and in addition, the person responsible for shipping the adulterated food may be fined.

Federal laws thus require scientific and tested proof of safety of agricultural chemicals before they can be sold for use in production of foods and, further, place definite restrictions on their use in order to safeguard the public.

State laws and regulations in more than 40 states either duplicate the Federal requirements within the state or establish similar requirements to protect the safety of consumers. Not only the Federal law, but many state laws require labeling to warn users of any possible hazards in using the chemicals. Some states require licensing of professional pesticide applicators.

In effect, these laws require that manufacturers must prove agricultural chemicals are safe and that they can be used properly to benefit the public before they can be sold.

Pesticides and public health.

Not only have pesticides protected our food, feed, and fiber from pests but they have contributed directly to our freedom from disease. Two authorities describe this contribution as follows:

"Probably the most dramatic accomplishment in public health in the last quarter of a century was the control of major epidemics of louse-borne typhus in densely populated, heavily-infested populations under wartime conditions.... Although immunization was of value, especially in protecting expert personnel carrying out control work, it has been pointed out by Bayne-Jones and others that it was the judicious use of insecticidal powders that actually stopped the epidemics. It has been estimated that there were 5,000,000 cases of typhus in Russia alone following World War I. By contrast, the number of civilian cases in the Near East, North Africa, Italy, Germany, Korea, and Japan during World War II appears to have been less than 5,000."

"W. J. Hayes, Jr.
"S. W. Simmons
"Communicable Disease Center,
Department of Health, Education
and Welfare."

In their role as lifesavers, pesticides protect foods from contamination by disease-carrying flies and rodents, harmful worms, fungi, and bacteria which have for centuries caused many human diseases or rendered food unfit for human consumption.

Even so, the use of these chemicals has been the subject of vicious attacks from some individuals who claim pesticides are responsible for a variety of human ailments. Fortunately, this opinion is held by only a small minority of the public.

Studies conducted by public health officials have failed to substantiate the claims made by these people. Hayes and Simmons, who conducted much of the work, sum up their studies concerning this problem by stating:

"In conclusion, the newer pesticides have, in comparison with the older ones, a good safety record. This is in large part due to intelligent enforcement of the Federal Insecticide, Rodenticide, and Fungicide Act, and of similar legislation in the various states. Educational campaigns carried on by a great variety of groups, including industry, have helped tremendously to familiarize users with the facts and to establish the custom of reading the labels on economic poisons. The American Medical Association, The U. S. Public Health Service, and others have called the attention of physicians to the symptomatology and treatment of intoxication caused by various pesticides.

"Since a great many new pesticidal compounds have been introduced in the last decade, it is obvious that many problems require further scientific study. There is nothing to be gained in the long run, however, by irresponsible statements that nothing is now known of the toxicology of the newer pesticides, or that no legal control of their use exists, or--in the absence of epidemiological proof--that a wide variety of illness from which mankind has suffered for generations is now caused by intoxication by the newer economic poisons."

In a paper presented at a CDC training session on Epidemiology and Control of Vector-Borne Diseases, File 6-20, 1959, Dr. Hayes again emphasized the favorable record of the modern pesticide by stating:

"For many years the mortality associated with acute poisoning by liquid and solid substances has been about one per 100,000. Over a period of 50 years, there has been a general improvement resulting in this present record. There was no change in mortality statistics associated with the tremendous increase which has occurred in the use of pesticides since World War II. It may be concluded, on the basis of several studies, that pesticides cause slightly less than 10 percent of cases of poisoning caused by solids and liquids in the United States. This is true whether one refers to fatal cases or to all cases of poisoning."

Nature's balance and wildlife.

Frequently, insecticides are accused of upsetting the balance of nature, when in many instances it would be more accurate to say they are used to suppress an organism already out of balance. Actually, man himself in his quest for food and shelter has been a primary factor in upsetting the so-called natural balance. When he plowed the land, developed a new crop, drained a marsh, dammed a stream, or even build a house, he altered an entire environmental complex and established an entirely new set of opposing forces.

Often this new situation favored man; more often it unleashed a host of pests to compete for available food or other material. In nature, every living organism is engaged in the most ruthless kind of competition with every other organism upon which its interests overlap. Man is a part of that environment. That man has been successful is evidenced by the fact that he has prospered and that the human population of this country has risen from less than one million to over 170 million in 15 to 20 generations. To maintain this position of dominance will

require that man use every means at his command to keep the balance in his favor. The frontier has all but disappeared for the acquisition of new agricultural lands. To maintain an adequate food and fiber supply in the future means that farmers will be required to rely on new advances in agricultural technology, including even greater use of pesticides.

Man's struggle to survive occasionally requires that wildlife move from its chosen environment and, less frequently, causes some casualties. Man is not indifferent to this situation and has spent large sums for refuge areas where wildlife is always protected. In addition, in the war against pests he tries to protect wildlife by establishing developmental and pest control practices which will not permanently impair its well-being. Laws have been passed to protect wildlife from many of the hazards created by man. In administering these laws man's needs are also respected and have been so stated by Walter W. Dykstra, U. S. Fish and Wildlife Service:

"In its appraisal of the situation, the Fish and Wildlife Service recognizes that pest control is necessary for the production of food and the protection of health for man and domestic animals. Blanket condemnation of the use of pesticides is neither reasonable nor practical. Many of these materials can and are being used with little or no significant harmful effects on fish or wildlife. Their use in the suppression of destructive and disease-bearing pests at times indirectly contributes to food, shelter, and health for wildlife as well as for man. Some of these materials are useful tools in wildlife management."

Wildlife, because of varying susceptibility of the different species and their relationship to their environment, offers special problems not encountered by man and his domestic animals. Its food habits differ and exposure to treated foliage is often more intense. In view of these factors it is not surprising that the frequency of adverse effects to wildlife is slightly greater than to domestic animals. At the same time, the preponderance of adverse effects has been limited to restricted areas, due to accident or to outright experimentation. When the amount of insecticides used in the last 50 years is compared to losses, the impact on wildlife has not been great and certainly not disastrous. When pesticides are compared to other factors in wildlife environment the Department of Fish and Game Management, State of California, holds this view:

"Considered in its broadest scope, at the present time pesticides seem to be only minor influents in nature compared to other factors in land and water development and use. Urbanization, industrial pollution, drainage of marshlands, bringing land into cultivation--to name a few such factors--all constitute greater hazard to wildlife survival than chemical use."

To be honest, we must look for the good as diligently as we look for the bad in any appraisal of the effects of pesticides on wildlife. Unfortunately, harmful side-effects are usually readily apparent, whereas indirect beneficial results are apt to pass totally unobserved.

The ultimate effect of insecticide usage on animal life cannot always be measured in terms of mortality to a few individuals of a species. In reality, an appraisal must reflect the long-term effects on both plant and animal life. Since animals

are largely dependent upon plants for both food and shelter, is it not possible that the destruction of timber, range vegetation, or cultivated crops by insects may produce a chain reaction that will ultimately affect all of the forms of life in the area.

Cooperative state-Federal programs.

Pest control for the most part is a standard practice on the American farm. Farmers determine their individual pesticide needs when they face the possibility of losing their crops. They are guided by recommendations made by the agricultural colleges through the Extension Service and accept the full responsibility for using the chemicals of their choice. Farm use accounts for the bulk of the pesticides applied in the United States.

Cooperative state-Federal pest control programs are initiated only when it has been clearly established that the problem is beyond the scope of individual action. There must be a need for public assistance and any assistance rendered must be in the interest of the general public.

Carefully trained and experienced personnel supervise cooperative state-Federal programs. Those in charge of these programs are in a position--through knowledge and experience--to recognize adverse reactions which can be expected in the early stages of a relatively large program. They can and do take corrective measures immediately. While local loss of beneficial forms of life is regrettable, no such loss has proven to be permanent.

Chemicals have found their proper place in agriculture and as a valuable tool in public health programs. They are needed by farmers, public health officials, conservationists, and others to preserve our way of life. Rather than deny these people the use of these modern, effective tools, we believe a more practical approach to be the encouragement of wise and judicious use of these chemicals. By following this approach we can continue to enjoy the benefits they provide.

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